

MICHIGAN DEPARTMENT OF NATURAL RESOURCES & ENVIRONMENT

INTEROFFICE COMMUNICATION

TO: File

FROM: Izabel Hartman

DATE: February 28, 2011

SUBJECT: State Revolving Fund Project No. 5460-01
8 ½ Mile Relief Drain Drainage District (Chapaton RTB Energy Improvements)
Green Project Reserve (GPR) Funding Cost Calculation

The purpose of this memo is to document the cost calculations for the green reserve funding for the 8 ½ Mile Relief Drain Drainage District, SRF Project No. 5460-01. The total loan amount is \$705,000. The portion of the project that qualifies as green is the boiler replacement and intra-red heater installation (\$234,989.87), light fixture improvements (\$28,090.61), and photovoltaic (solar) panel installation (\$148,987.50). The total cost of construction for the green portion of the project is \$412,067.98. The total eligible construction cost for the entire SRF project (excluding crew days) is \$514,185.50. In order to determine the percentage of non-construction costs associated with the green portion of the project, a proration was applied, as shown below:

$$412,067.98 / 514,185.50 = 0.8014$$

$$705,000 \times 0.8014 = \$564,987$$

The total amount of green reserve funding for this project comes to \$564,987.

The principal forgiveness amount was determined using 50-percent of GPR associated costs.

$$564,987 \times 50\% = \$282,493.50$$

Therefore, the total principal forgiveness amount for the project is \$282,494.

EXECUTIVE SUMMARY

This project plan is prepared to present the need for energy improvements at Chapaton Pump Station, also known as Chapaton Retention Treatment Basin (RTB). It is also the intention to document the basis for determining that the energy improvement project at Chapaton pump station qualifies for the Green Project Reserve (GPR) funding administered by the Michigan Department of Natural Resources and Environment's (MDNRE) State Revolving Fund (SRF) program, which addresses green infrastructure, water or energy efficiency improvement projects.

The Chapaton RTB services nearly entire area of City of Eastpointe, and portion of City of St. Clair Shores, covering an area of approximately 3,068 and 1,221 Acres, respectively. The Chapaton system is the largest system within the Southeast Macomb Sanitary District (SEMSD). The separated and combined flows from the Chapaton system are conveyed through two major interceptors: 9 – Mile Drain and 8 ½ - Mile Drain. The dry weather flows from the interceptor and the de-watering flow from the Chapaton Retention Treatment Basin discharge into the Jefferson Interceptor.

The proposed project involves improvements to facility systems that consume energy (i.e. lighting, heating, and cooling), improvements to ventilation system for healthy/safe work environment and installation of renewable energy source. Improvements are needed to replace inefficient and out-dated equipment and systems, reduce energy consumption, and provide environmental benefits. Without this project the communities will continue to pay for higher energy consumption and potential future energy price hikes. The communities' revenue has been decreasing recently on account of population migration and increasing housing foreclosures. Section B below provides a snapshot on economic characteristics in project region. It is also anticipated that some of the existing equipment is at the end of its useful life and subject to failure due to age. Because of these issues, the proposed project and the funding is required to alleviate the problems described herein reduce operational costs into the future.

The pump station has no plans for expansion and has been servicing the region for more than 40 years. Because of higher energy consumption of equipment due to age, availability of new, more efficient equipment that was not available during time of initial construction, and station operational history to allow for equipment optimization, the existing facility equipment and systems should have room for significant reduction in energy consumption. An energy audit for the building was conducted in May 2010 to evaluate this potential. **The improvements will result in reduced energy consumption through increased optimization of energy use and through use of more energy efficient equipment.** In addition, these improvements will reduce the operational costs of the facility resulting in reduced user fees and provide net environmental benefit through reduced energy demand.

The proposed alternative compared to No Action alternative is related to energy improvements at the Chapaton pump station. Some of the improvements contribute indirectly towards reduction in energy use or directly by increasing the efficiency of equipment resulting in energy savings. The improvements are summarized below:

Optimum Performance of Pump Station Energy Consumption Target Areas:

- Windows and doors – Replacement of old drafty windows and doors with modern insulated equivalents will reduce the heat gain during summers and prevent heat loss during winters. This provides reduction in energy consumption by reducing the energy load required for the heating and cooling systems.
- Boiler – Replacement of the existing boiler with a modern more efficient unit will directly result in reducing energy consumption.
- Unit heaters – The infrared heaters are the most efficient heating units available on the market today. These work by warming the objects in the room rather than warming the air. In case of two-story pump room, the warm air from existing heaters does not reach the floor effectively. Replacement of the existing heaters with this new technology will directly reduce the energy consumption of the facility while improving relevant heating required at the facility.
- Lighting – The replacement of existing mercury vapor lighting with fluorescent units with a substantial reduction in energy consumption for the same light emission will directly reduce energy consumption at the facility. In addition, the new lighting system has a significant longer lamp-life than current lighting units, resulting in lower maintenance costs over time.

Operational Improvements:

- Ventilation – The addition of a make-up air unit will allow the facility to meet the Ten State Standards and NFPA requirements that were not in place when the facility was constructed. This is a vital upgrade required to modernize the facilities compliance and to provide healthy/safe work environment.

Renewable Energy:

- Photovoltaic Panels
 1. The Chapaton Retention Treatment Basis facility has a large deck area approximately 1300 feet by 200 feet located above the underground basin. Portions of this area are used seasonally for boat launch parking, overflow parking for and adjacent restaurant, and public bus turnaround. Most of the northern portion of the deck has direct sun exposure and is typically unused.
 2. The facilities pumping station also utilizes significant loads of electrical power, making the evaluation of a photovoltaic system very favorable for this facility.
 3. The local power company DTE has an active program, SolarCurrents for renewable energy offsets. This program is limited to systems with installed photovoltaic (PV) capacity up to 20 kilowatts (kW). The program offers \$2.4 per installed watt credit after construction is completed and a net metering renewable energy credit (REC) of \$0.11 kilowatt hour (kW-hr) produced by the PV system in addition to existing load offsets. However, this program is currently available for installations in 2010, and will likely be extended for future years but the actual incentives will not be made available until the end of 2010. For PV systems installed above 20 KW in size specific negotiations and evaluation by DTE would be required to establish any rate for energy sold back to the grid above the facility load off-sets and could be as low as \$0.03 per KW-hr.
 4. The PV system evaluated is rated at 19.5 kW will result in an approximate annual energy production of 23,000 kW-hr.

The summary of energy and cost savings is provided below:

	Energy Units	Existing		Improvements		Annual Savings	Percent Energy Reduction	Capital Cost	Simple Payback Period, Years
		Annual Energy Consumption	Annual Energy Costs	Annual Energy Consumption	Annual Energy Costs				
Replace boiler & windows	kBtu	1,764,858	\$17,972	1,117,394	\$11,378	\$6,593	37%	\$92,325	14
Infra-red heaters	kBtu	987,200	\$10,053	604,800	\$6,159	\$3,894	39%	\$31,150	11
Light fixtures	kWh	64,845	\$9,078	15,188	\$2,430	\$6,648	73%	\$32,590	7
TOTAL		--	\$37,103	--	\$19,967	\$17,135			
Light Fixtures Maintenance Cost		--	\$333	--	\$150	\$183			

And the project cost summary is provided below:

IMPROVEMENTS	UNIT	QUANTITY	UNIT PRICE	AMOUNT
Replace windows & one external door	EA	19	\$ 1,250.00	\$ 23,750.00
Boiler	LS	1	\$ 92,325.00	\$ 92,325.00
Infra-red heaters	LS	1	\$ 31,150.00	\$ 31,150.00
Make-up air unit	LS	1	\$ 44,437.50	\$ 44,437.50
Light fixtures	LS	1	\$ 32,590.00	\$ 32,590.00
Photovoltaic panel installation	LS	1	\$ 125,274.67	\$ 125,274.67
TOTAL CAPITAL COSTS				\$ 349,527.17
Contingencies			15.0%	\$ 52,429.08
Construction Management (CCA)			8.0%	\$ 27,962.17
Engineering, Design & Legal			10.0%	\$ 34,952.72
Administration/Loan Management			7.0%	\$ 24,466.90
TOTAL PROJECT COSTS				\$ 489,338.04

The net present worth for the energy system improvements, operational improvement and renewable energy system is compared with the existing/No Action conditions. Because of the availability of principal forgiveness for GPR projects, the net present worth is also compared assuming 40% principal forgiveness. The monetary evaluation for renewable energy source is conducted for additional scenarios with and without DTE's REC. Summary of the monetary evaluation is provided below:

	Energy Improvements		Operations Improvement		Renewable Energy Source	
Existing Annual Electric Usage, kW-hr	56,740		--		629,000	
Existing Annual Natural Gas Usage, kBTU	2,752,058		--		--	
Post-Implementation Annual Electric Usage, kW-hr	15,188		--		605,997	
Post-Implementation Annual Natural Gas Usage, kBTU	1,386,916		1,328,831		--	
Capital for Improvements	\$251,741		\$49,770		\$175,385	
Assumed Principal Forgiveness Percent	0%	40%	0%	40%	0%	40%
DTE's Upfront RE Credits for Improvement	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 46,769
Annual Payments on Net Loan at 2.5% Interest	\$ 16,148	\$ 9,689	\$ 3,193	\$ 1,916	\$ 8,250	\$ 4,950
PRESENT WORTH FOR 20 YEARS						
Existing Energy Costs	\$ 871,485	\$ 871,485	\$ -	\$ -	\$ 1,773,640	\$ 1,773,640
Post-Improvement Energy Costs	\$ 401,386	\$ 401,386	\$ 343,544	\$ 343,544	\$ 1,708,777	\$ 1,708,777
Loan Payment	\$ 322,969	\$ 193,782	\$ 63,852	\$ 38,311	\$ 165,006	\$ 99,004
Existing O&M Costs	\$ 4,331	\$ 4,331	\$ -	\$ -	\$ -	\$ -
Post-Improvement O&M Costs	\$ 1,956	\$ 1,956	\$ -	\$ -	\$ 13,008	\$ 13,008
DTE's Energy Production RE Credits	\$ -	\$ -	\$ -	\$ -	\$ 50,606	\$ 50,606
Total Existing Net Present Worth	\$ 875,816	\$ 875,816	\$ -	\$ -	\$ 1,773,640	\$ 1,773,640
Total Improvement Net Present Worth	\$ 726,311	\$ 597,124	\$ 407,396	\$ 381,855	\$ 1,836,185	\$ 1,770,182
Net Present Worth Comparison - Existing v/s Improvement	\$ (149,506)	\$ (278,693)	\$ 407,396	\$ 381,855	\$ 62,545	\$ (3,458)

From the above table, energy improvements provide a net benefit by reducing costs over 20 years evaluation period. This benefit increases with principal forgiveness. There is no net cost reduction for operational improvement because make-up air unit does not exist on-site currently. For renewable energy source augmentation to the existing DTE source, net benefit is derived especially when principal forgiveness and DTE's RE credits are taken into account.

The Chapaton Sub-District includes the entire City of Eastpointe, and part of City of St. Clair Shores. The apportionment percentage in the district is as follows:

- City of Eastpointe – 54.33467%
- City of St. Clair Shores – 25.12872%
- Macomb County – 4.49975%
- State of Michigan – 16.03686%

Based on this, the total cost of the project is apportioned. The user charge is calculated for repayment of 100% of the loan amount. However, subsidy in the form of principal forgiveness is anticipated from MDNRE for energy conservation projects. The user charge based on 100% loan repayment, to each Residential Equivalent Unit (REU) is provided below:

	Apportionment	Annual User Charge	2009 SEMCOG Estimated Population	REU Factor	No. of REU	Average Monthly Estimated User Charge Per REU, (over 20 years)
City of Eastpointe	54.33467%	\$16,847.46	33,183	2.43	13,656	\$0.1028
City of St. Clair Shores	25.12872%	\$7,791.62	59,591	2.15	27,717	\$0.0234
Macomb County	4.49975%	\$1,395.23	832,996	2.41	345,641	\$0.0003
State of Michigan	16.03686%	\$4,972.52	--	--	--	--

The following provides the justification for Green Project Reserve eligibility of the Project Plan components.

Optimum Performance of Target Pump Station Energy Systems

- **Boiler** – This is Categorically eligible as a high energy use system that results in at least a 20% reduction in energy consumption. According to the table in section B above, the current boiler uses 1,764,858 kBtu/yr. Replacement of the boiler will result in a savings of up to 982,742 kBtu/yr or 56% energy savings.
- **Windows and doors** – Work in conjunction with Boiler replacement to maximize energy efficiency. Alone window replacement would result in a reduction on heating load for the boiler and cooling system, done in conjunction with major upgrades to the boiler it results in an overall energy savings of 56% as seen in the table in section III.B above. Additionally the replacement of windows can be justified as a significant source of energy savings under the recommendation of the energy audit done on the Chapaton Pump Station (Appendix D).
- **Unit heaters** – This is Categorically eligible as a high energy use system that results in at least a 20% reduction in energy consumption. According to the table in section B above, the current unit heaters use 987,200 kBtu/yr. Replacement of the unit heaters with efficient infrared heaters will result in a savings of 382,400 kBtu/yr or 39% energy savings. Additionally the replacement of heaters can be justified as a significant source of energy savings under the recommendation of the energy audit done on the Chapaton Pump Station (Appendix D).
- **Lighting** – This is Categorically eligible as a high energy use system that results in at least a 20% reduction in energy consumption. According to the table in section B above, the current lighting system uses 64,845 kWh/yr. Replacement of the lighting system will result in a savings of 49,657 kWh/yr or 73% energy savings. Additionally the replacement of the lighting system can be justified as a significant source of energy savings under the recommendation of the energy audit done on the Chapaton Pump Station (Appendix D).

Renewable Energy

- **Photovoltaic Panels** – This is a renewable energy component and therefore is categorically eligible as GPR project.

The improvements projects will result in long term positive impact. The improvements associated with energy systems will result in energy savings through optimized energy use and through improving energy efficiency of the equipment. Additionally, improving the energy consuming systems will reduce the operational costs and provide environmental benefits through reduced green house gases and decrease in consumption of natural resources.

B. ANALYSIS OF PRINCIPAL ALTERNATIVES

The alternatives described above are related to energy improvements at the Chapaton pump station. Optimization of existing facility results in energy savings as provided below

- Windows and doors – Reduces the heat gain in pump room during summers and prevent heat loss during winters. This helps in reducing the energy load on the heating and cooling systems.
- Boiler – The higher efficiency system will directly result in reducing energy consumption sized as appropriate for reduced loads.
- Unit heaters – The infrared heaters are the most efficient heating units for large spaces on the market today. These work by warming the objects in the room rather than warming the air. In case of two-storied pump room, the warm air from existing heaters does not reach the floor effectively. This directly reduces the energy consumption for heating.
- Lighting – The proposed improvement is a direct energy saving.
- Ventilation – Make-up air unit will meet the Ten State Standards and NFPA requirements which are currently not met by the facility.
- Renewable Energy – The Chapaton Retention Treatment Basis facility has a large deck area approximately 1300 feet by 200 feet located above the underground basin. Portions of this area are used seasonally for boat launch parking, overflow parking for and adjacent restaurant, and public bus turnaround. Most of the northern portion of the deck has direct sun exposure and is typically unused.

The facilities pumping station also utilizes significant loads of electrical power, making the evaluation of a photovoltaic system very favorable for this facility.

The local power company DTE has an active program, SolarCurrents for renewable energy offsets. This program is limited to systems with installed photovoltaic (PV) capacity up to 20 kilowatts (kW). The program offers \$2.4 per installed watt credit after construction is completed and a net metering renewable energy credit (REC) of \$0.11 kilowatt hour (kW-hr) produced by the PV system in addition to existing load offsets. However, this program is currently available for installations in 2010, and may be extended for future years. For PV systems installed above 20 KW in size specific negotiations and evaluation by DTE would be required to establish any rate for energy sold back to the grid above the facility load off-sets and could be as low as \$0.03 per KW-hr.

The PV system rated at 19.5 kW will result in an approximate annual energy production of 23,000 kW-hr.

B.2. GPR Eligibility

The following provides the justification for Green Project Reserve eligibility of the Project Plan components.

Optimum Performance of Target Pump Station Energy Systems

- *Boiler* – This is Categorically eligible as a high energy use system that results in at least a 20% reduction in energy consumption. According to the table in section B above, the current boiler uses 1,764,858 kBtu/yr. Replacement of the boiler will result in a savings of up to 982,742 kBtu/yr or 56% energy savings.
- *Windows and doors* – Work in conjunction with Boiler replacement to maximize energy efficiency. Alone window replacement would result in a reduction on heating load for the boiler and cooling system, done in conjunction with major upgrades to the boiler it results in an overall energy savings of 56% as seen in the table in section III.B above. Additionally the replacement of windows can be justified as a significant source of energy savings under the recommendation of the energy audit done on the Chapaton Pump Station (Appendix D).
- *Unit heaters* – This is Categorically eligible as a high energy use system that results in at least a 20% reduction in energy consumption. According to the table in section B above, the current unit heaters use 987,200 kBtu/yr. Replacement of the unit heaters with efficient infrared heaters will result in a savings of 382400 kBtu/yr or 39% energy savings. Additionally the replacement of heaters can be justified as a significant source of energy savings under the recommendation of the energy audit done on the Chapaton Pump Station (Appendix D).
- *Lighting* – This is Categorically eligible as a high energy use system that results in at least a 20% reduction in energy consumption. According to the table in section B above, the current lighting system uses 64,845 kWh/yr. Replacement of the lighting system will result in a savings of 49,657 kWh/yr or 73% energy savings. Additionally the replacement of the lighting system can be justified as a significant source of energy savings under the recommendation of the energy audit done on the Chapaton Pump Station (Appendix D).

Renewable Energy

- *Photovoltaic Panels* – This is a renewable energy component and therefore is categorically eligible as GPR project.

B.3. Environmental Evaluation

The Chapaton pump station is located in urban developed area. The 9 Mile Canal and Lake St. Clair are adjacent to the facility. Residential complexes are located both to the North and South of the basin, and an outside seating restaurant is located to the South of the facility entrance.

All the improvements projects are located within the pump station, and therefore there are no environmental impacts anticipated.